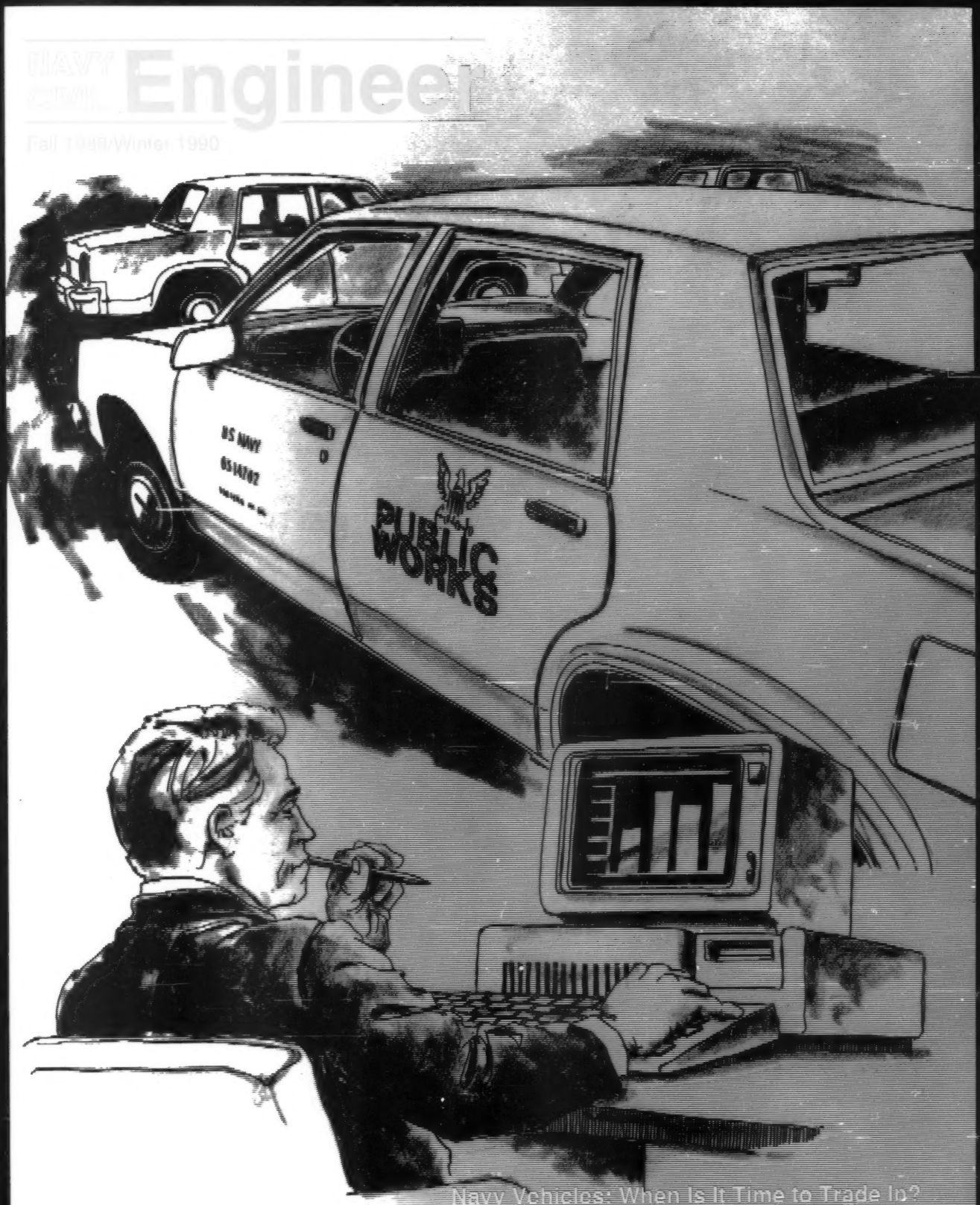
NAVY CIVIL Engineer
Fall 1989/Winter 1990



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Speaking from Topside

I am deeply honored and very excited about the opportunity to serve as Chief of Civil Engineers and Commander, Naval Facilities Engineering Command. The CEC/Seabee/civilian family is an outstanding group with whom I have been privileged to serve. At every occasion and in every circumstance, I find dedicated, skilled individuals who are willing to do what it takes to support the operating forces of our Navy and Marine Corps. Together, working as a team, I know that we will continue to provide the fleet a strong, responsive shore base from which to operate.

I would be remiss in not expressing a heartfelt thank you and fond farewell to Rear Admiral Montoya. His dynamic leadership and sensitivity to the individual not only improved our ability to get the job done, but left NAVFAC a better place to work.

We face challenging times ahead. The dramatic upheaval in Eastern Europe is far from over. The crumbling of the Iron Curtain, corresponding as it has to sharply increased budget pressure at home, has led many to call for greatly reduced military spending and a much reduced defense establishment.

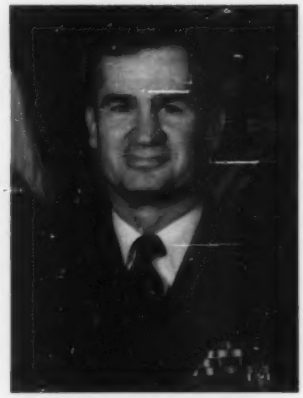
Although the final outcome is uncertain, the prospect for eased tension in the world is indeed gratifying. I believe that we must remain vigilant, however, and only after a careful analysis of force structure requirements can be completed should any consideration of shore establishment realignment be undertaken. Ultimately, I believe the Navy that enters the 21st century will be a smaller, but more capable service of which the NAVFAC/Seabee/CEC family will be an integral part.

Near-term, we will all struggle with budget drills, constrained resources, seemingly unending requirements, and lots of rumors. I encourage each of you to stay the course and continue to seek innovative ways to provide our operating forces the best possible support with the resources available.

There are three particular aspects of our business that I would address:

• **Headquarters role.** Headquarters has three primary roles: obtain and allocate resources, establish policy, and provide oversight of field operations. Execution belongs in the field. I believe the current climate of change will enable us to streamline headquarters' role so as to better support field operations and contribute to delivery of quality products to our customers.

• **Public works.** Our public works departments and centers are at the point of delivery of facility services to the operating forces of the Navy and Marine Corps. While the importance of our engineering field divisions and other activities must not be diminished, I believe we must rededicate ourselves to providing well-maintained facilities that efficiently support whatever mission the particular customer happens to perform. Each customer is important and deserves the very best we can provide. Through our public works operations, I believe we can best contribute to the ability of the operating forces to meet mission requirements. I plan to seek ways to enhance our public works operations and solicit your support in this effort.



RADM David E. Bottorff, CEC, USN

• **Teamwork.** Clearly, neither I nor any other individual has the training and skill to meet every facet of the needs of the Navy's shore establishment. With teamwork, however, each individual can contribute his or her unique skill and talent with the result that the product is improved and the customer receives the best possible support. It is vital that, at all levels, we foster team-building and recognize that each discipline, each individual, and each command element has a valid, important role to play in our overall effort to support the fleet. I solicit your support in this effort also.

I look forward to seeing many of you during the coming months and know that I can count on you to continue your efforts to deliver the best possible support to the fleet.

David E. Bottorff

DAVID E. BOTTORFF
Rear Admiral, CEC, USN
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P-300 Revisited

An alternative method to determine when vehicles should be replaced

By LT David M. Boone, CEC, USN

Navy vehicles are expensive to purchase, maintain and repair. Decisions must be made in the management of a vehicle fleet to determine when vehicles should be replaced. According to the NAVFAC P-300 (Management of Transportation Equipment handbook), age and mileage expectancies from the Construction, Automotive and Specialized Equipment Management Information System (CASE/MIS) report should be used as guidelines for replacing, overhauling or retaining vehicles.

However, is this a sound way to do business? Should these management decisions be based totally on the vehicle's age and mileage? A look at those questions and a method to determine when a class of equipment should be replaced was taken in a 1989 study at the Navy Public Works Center, Pensacola, Fla.

To base management's decisions for replacing vehicles solely on age and mileage might be misleading and economically unjustified. Other factors should be considered, such as maintenance costs and the cost of the replacement vehicle itself. The local economy may also be a factor. Maintaining a vehicle in the southern areas of the United States is probably cheaper than maintaining the same vehicle in other major metropolitan areas. The analysis should be sensitive to local situations.

An article written in the *Journal of Construction Engineering and Management* (American Society of Civil Engineers, Vol. 110, No. 2, June 1984) stimulated interest in applying a life cycle analysis to Navy vehicles. The article entitled "Optimum Equipment Life by Minimum Life-Cycle Costs" was co-written by Courtland A. Collier, a University of Florida associate professor, and Lieutenant Commander David E. Jacques, CEC, USN.

It discusses a computer program written in BASIC that provides a model to determine when vehicle replacements should be made. The model compares the present worth of life cycle costs for an existing vehicle (the Defender) against the expected life cycle cost for the proposed replacement (the Challenger) examined at different trial life spans. This methodology was adapted to examine Navy vehicle life cycles.

Methodology

The data inputs for the model for both the Defender and Challenger are:

- Original purchase price
- Rate of decline of salvage value
- Repair costs
- Tire costs
- Downtime costs
- Obsolescence costs
- Maintenance costs
- Accessory costs
- Taxes and insurance costs
- Overhaul costs
- Depreciation life
- Defender's age
- Present net salvage value

LT David M. Boone is the aide to the commander, Naval Facilities Engineering Command in Alexandria, Va. At the time he wrote this article, he was the special projects manager at the Public Works Center in Pensacola, Fla. He is a registered professional engineer in Florida.

The data that the Navy system collects on vehicles are not broken down into the above listed categories, and some categories are not even applicable to Public Works Centers. The following simplifications were used in our analysis:

- The repair costs, tire costs, maintenance costs and overhaul costs were combined as a single entry in either *maintenance costs* or *repair costs*. (The reason for two options will be explained later.)
- Accessory costs were ignored.
- Taxes and insurance were ignored.
- It was assumed the Challenger will have the same *maintenance costs* or *repair costs* as the Defender.

Therefore, the inputs used in our study were:

- Original purchase price
- Rate of decline of salvage value
- Maintenance costs or repair costs (total of repair costs, maintenance costs, tire costs, and overhaul costs)
- Downtime costs
- Obsolescence costs
- Depreciation life
- Defender's age
- Present net salvage value

For each of the input factors, the program calls for the *First coming year's cost* (the initial cost) and the *cost gradient* (the amount of increase or decrease in cost each year). The *cost gradient* is used to predict the future costs, which are then computed in terms of present worth.

Two types of gradients are available; the one used depends upon whether the *maintenance costs* or *repair costs* entry is used. The *repair costs* uses an arithmetic gradient, which is a linear model, and the *maintenance costs* uses a geometric gradient, which is an exponential model.

As previously stated, all the repair costs, tire costs, maintenance costs, and overhaul costs are combined into a single entry in either *maintenance costs* or *repair costs*. A determination has to be made about the shape of the total annual maintenance cost curve, which will be graphed using this information. If it is to be a linear model, then the data is inputted into *repair costs*. If the curve is to be more exponential in shape, then the data is entered into *maintenance costs*.

Trying to determine the shape of the total annual

Annual Maintenance Costs for 6 Panel Trucks (ECC 0329)
(Panel trucks were acquired in July 1986)

1986

Vehicle	Labor Hours	Labor $	Material $	Total $	Miles Driven
94-27771	0.00	0.00	0.00	0.00	573
94-27772	0.00	0.00	0.00	0.00	111
94-27773	0.00	0.00	0.00	0.00	573
94-27774	1.00	30.16	0.00	30.16	0
94-27775	0.00	0.00	0.00	0.00	303
94-27776	0.00	0.00	0.00	0.00	356

1987

Vehicle	Labor Hours	Labor $	Material $	Total $	Miles Driven
94-27771	1.70	57.19	0.00	57.19	4,766
94-27772	0.00	0.00	1.70	1.70	982
94-27773	1.30	43.73	8.97	52.70	4,858
94-27774	1.70	57.19	0.00	57.19	0
94-27775	0.00	0.00	0.00	0.00	4,966
94-27776	0.00	0.00	0.00	0.00	4,011

1988

Vehicle	Labor Hours	Labor $	Material $	Total $	Miles Driven
94-27771	3.00	105.45	11.00	116.45	4,746
94-27772	5.00	175.75	43.00	218.75	1,265
94-27773	4.00	140.60	6.00	146.60	7,255
94-27774	2.00	70.30	12.00	82.30	7,349
94-27775	1.00	35.15	6.00	41.15	3,645
94-27776	3.00	105.45	26.00	131.45	5,789

NOTE: The hourly labor costs increased each year.
They were: FY 1986 - $30.16 / hour
FY 1987 - $33.64 / hour
FY 1988 - $35.15 / hour

Figure A

Comparison of Annual Maintenance Costs for 6 Panel Trucks
(In dollars)

	Vehicle					
Year	27771	27772	27773	27774	27775	27776
1986	0.00	0.00	0.00	30.16	0.00	0.00
1987	57.19	1.70	52.70	57.19	0.00	0.00
1988	116.45	218.75	146.60	82.30	41.15	131.45

Figure B

maintenance cost curve turned out to be the most critical and difficult task in this study.

To determine the vehicle's future costs, several avenues were investigated. Numerous government reports and documents were examined for this information as well as other branches of the armed forces, car rental agencies, truck rental agencies, the General Services Administration, and the vehicle manufacturers themselves; all with no success.

The next option was to use existing data to try to project costs into the future. Seven vehicle categories, called Equipment Cost Codes (ECC), were selected for the analysis. In each ECC, six vehicles were chosen and their annual maintenance costs (both labor and materials) were tabulated in a Lotus spreadsheet from the 5H38 report (Public Works Center report with vehicle data).

For the sake of simplicity, only one of seven vehicle categories (panel trucks) will be shown in this article (Figure A).

The vehicles selected were all acquired in 1986, since the 5H38 is only available back to 1986. The annual maintenance costs for each vehicle were then graphed into total annual maintenance cost curves (using the data in Figure B), and a model line was determined that best represents the maintenance costs of all the vehicles. That model was then used to project maintenance costs in the future.

The points on the model line that best represented the data in Figure B were:

Year 1986 $ 15
Year 1987 $ 40
Year 1988 $115

Now a geometric gradient that best matches the above data is determined using the equation:

Summary Table of Total Present Values for 6 Panel Trucks

(In $1,000 Dollars)

Defender Life \ Challenger Life	1	2	3	4	5	6	7	8	9	10
0	27.2	24.0	21.5	19.7	18.8	19.7	23.1	32.0	52.6	98.8
1	24.4	21.6	19.4	17.9	17.1	17.8	20.8	28.6	46.5	86.7
2	21.8	19.4	17.5	16.1	15.5	16.1	18.7	25.4	41.1	76.0
3	19.6	17.5	15.8	14.7	14.1	14.6	16.9	22.7	36.3	66.7
4	17.7	15.8	14.4	13.4	12.9	13.4	15.3	20.4	32.2	58.6
5	16.2	14.6	13.3	12.5	12.0	12.4	14.1	18.6	28.8	51.8
6	15.4	14.0	13.0	12.2	11.8	12.2	13.6	17.5	26.4	46.4
7	16.0	14.8	13.9	13.2	12.9	13.2	14.5	17.8	25.6	43.0
8	19.5	18.5	17.6	17.1	16.8	17.0	18.1	21.1	27.8	42.9
9	29.4	28.5	27.8	27.3	27.0	27.3	28.2	30.8	36.6	49.8

Lowest present value found: Defender life - 6 years
Challenger life - 5 years

Figure C

Annual Maintenance Cost = $C(1 + r)^n$
where

C is the first year's maintenance cost
r is the rate of growth (or decline) - gradient
n is the year

From a trial and error process, the model curve in this case is best fitted with a growth rate of 167 percent, or 1.67. The following annual costs resulted:

Year 1	(1986)	$AMC = 15(1 + r)^0$	= $ 15
Year 2	(1987)	$AMC = 15(1 + r)^1$	= $ 40
Year 3	(1988)	$AMC = 15(1 + r)^2$	= $ 107
Year 4	(1989)	$AMC = 15(1 + r)^3$	= $ 284
Year 5	(1990)	$AMC = 15(1 + r)^4$	= $ 756
Year 6	(1991)	$AMC = 15(1 + r)^5$	= $2023

Some of the other ECC categories had data that was best represented with a linear line. In much the same way, the model line was determined with the gradient entered as *repair costs* rather than *maintenance costs*.

Once the data is entered, the output to the program is presented in the format shown in Figure C. The field of numbers represents the present value cost for any combination of retaining the Defender and obtaining the Challenger for specified periods of time. The optimum economic life cycle is then shown as the lowest number in the field. In this case, the output recommends that the existing vehicle should be replaced in six years and the new vehicle should be used for five years.

Analysis

The results seem reasonable. However, the following issues based on the analysis of all seven vehicle categories lead to uncertainties in this analysis:

- The projected annual maintenance costs is based on three years worth of actual data. Many vehicles in the three to five year life span dramatically increase in vehicle maintenance costs. This makes it difficult to predict gradients with any degree of certainty.

- There is a considerable "scatter" in the data which makes model curve determination difficult. In this study, the "scatter" was minimized by classifying the data according to ECC.

- There is no single entry for the different mileage of vehicles. The computer program accounts for mileage through increased maintenance costs. If most of the vehicles within a certain ECC are driven approximately the same amount, then the model will be more valid. Some of the vehicles, like sedans, may vary tremendously in mileage.

  The base police sedans often put on more than 100,000 miles a year while a sedan for a commanding officer may see only 10,000. Obviously these two vehicles cannot be lumped together in the same category (even if they are in the same ECC) and should be studied separately.

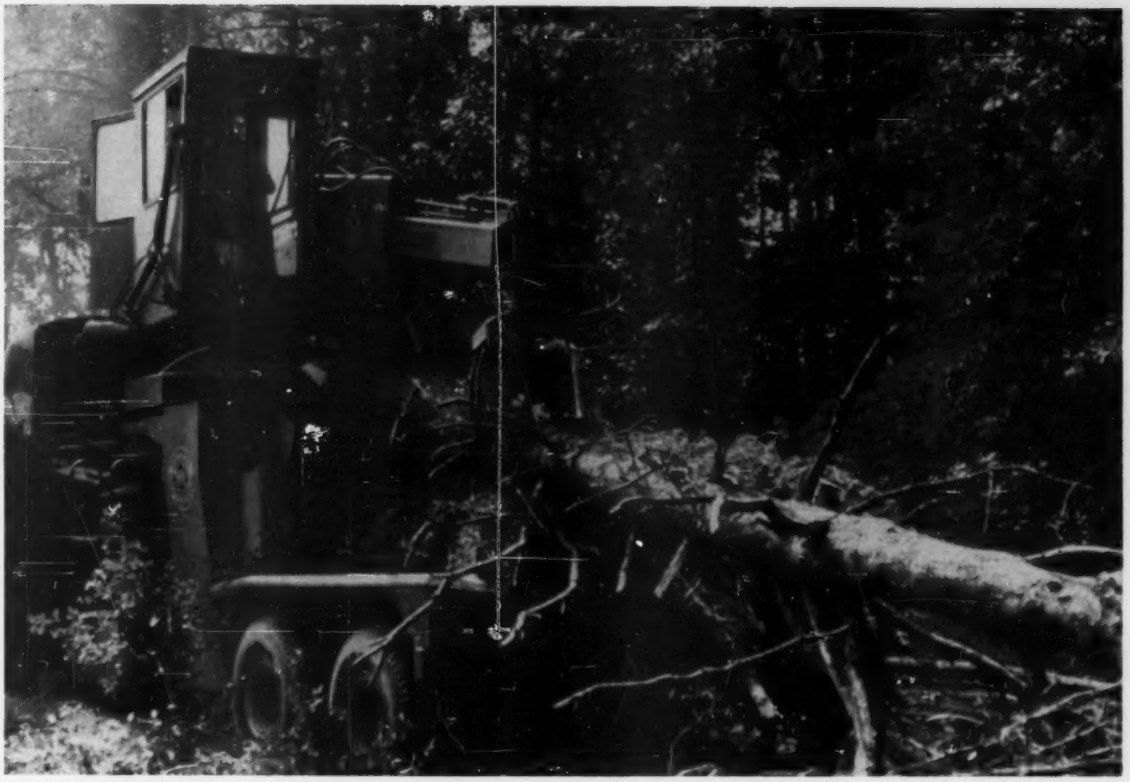
- The Defender's maintenance data is applied to the Challenger, which may or may not be accurate. Presumably, the Challenger should have improved technology, and therefore be cheaper to maintain.

- Low mileage and the subsequent low initial maintenance costs may also be misleading since much of the driving around our bases is "hard driving" involving short trips with a lot of starting and stopping. A vehicle with the same mileage but with much longer road trips would last longer in terms of the total miles driven.

The result of the analysis on the seven ECC categories revealed that the vehicle's replacement time should be either six years or nine years—six years if a geometric gradient (exponential model) was chosen and nine years if the arithmetic gradient (linear model) was used. Realistically, the geometric gradient probably represents the more accurate modeling for these vehicles and therefore, the six year replacement cycle would be used.

For all seven of these vehicle categories, the NAVFAC P-300 also recommends six years (shore station) as a replacement cycle. This study, at least for the small sample, has essentially verified the recommendations in the P-300.

While it may not be cost effective to go through this analysis manually for an entire fleet, it may be worth it to incorporate this as part of the PWC's automated analysis of its data base. As the data is received on all the vehicles, the system could generate this analysis on the fleet to determine which vehicles have "peaked" in their economic life and should be replaced. This would provide a much more objective means to manage our Navy fleet based on sound economic judgment. ❑



The timber harvest is part of the Navy forestry program at the Naval Surface Warfare Center in Dahlgren, Va.

The Navy's Natural Resources Program: What It Can Do for You

By Merrily Severance

Although the Navy natural resources program dates from the 1940s, the program is not highly visible.

What are natural resources and why does the Navy need a program to manage them? Natural resources are the portions of our natural environment—soil, water, rangeland, forests, wildlife—which can be used by man to promote his welfare. The natural resources program in the Navy focuses on renewable resources—living or dynamic resources whose harvest is dependent upon man's proper planning and management.

The Navy needs to manage its land and water areas for various reasons:

• First, the Navy should retain as much control over its land holdings as possible. Other agencies, such as the Bureau of Land Management and the U.S. Forest Service, are chartered to manage large areas of federal land. Allowing other federal agencies to manage Navy land would not ensure support for the Navy mission.

• Second, legislation requires federal agencies to provide conservation programs on its lands, to assess and minimize impacts of federal agency actions on the environment, and to protect special habitats and sensitive species.

• Third, management of our natural resources enhances our operations and maintenance.

• Fourth, proper management of natural resources is aesthetically pleasing and can provide opportuni-

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Merrily Severance is a natural resources management specialist at the Southwest Division, Naval Facilities Engineering Command in San Diego, Calif.

ties for outdoor recreation, which can increase the quality of life for military personnel.

• Fifth, a strong natural resources program demonstrates that the Navy is a good steward of federal lands and a good neighbor.

The Navy program

The Navy natural resources program is defined in Chapter 19 of the new Environmental and Natural Resources Protection Manual (OPNAVINST 5090.1A) and in volume II of the Naval Facilities Engineering Command (NAVFAC) Real Estate Operations and Natural Resources Management Procedural Manual, P73. The program, which is divided into four major subject areas, includes land management, forest management, fish and wildlife management, and outdoor recreation.

Land management is by far the broadest category and covers such activities as inventories of natural resources, wetlands identification, agricultural and grazing outleases, grounds maintenance, wildland fire management, and preparation of land management plans which assess current and potential uses of natural resources compatibility with military mission needs.

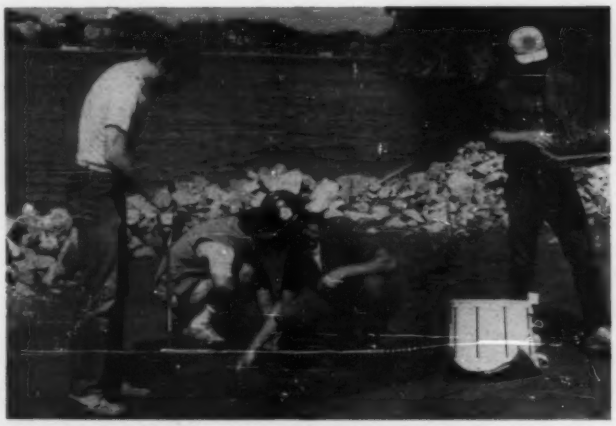
Forest management aims at producing forest products and maintaining the biological diversity of the Navy's forested areas. Fish and wildlife management develops programs for the conservation and management of fish, wildlife, and plant species. It can include hunting and fishing as well as protection of endangered species.

Outdoor recreation, a relatively new part of the program, enhances outdoor recreational opportunities directly associated with the natural environment. These include the development of nature trails, and picnicking and camping sites.

Resources professionals

The program is carried out with a small cadre of natural resource professionals. They can be found at the Naval Facilities Engineering Command headquarters, in the Engineering Field Divisions of NAVFAC, and at many activities which manage natural resources.

Natural resource professionals have a variety of educational backgrounds. There are foresters to manage timbered lands, wildlife biologists to look after wildlife concerns, including fishing and hunting programs, and range conservationists managing chaparral and rangelands. Soil conservationists identify capabilities of the soil for various uses and recommend the best uses of land resources, erosion control, landscaping, and crops. Other natural resource specialists are biologists, botanists, agronomists, and ecologists, who provide expertise on a broad range of natural resource issues.



This shore stabilization project protects Navy land resources and re-establishes wetlands at Naval Station Annapolis, Md.

How natural resources can help

As with any tool, the natural resources program is of limited value unless used properly. There are many areas of the facilities business where the natural resources professional can provide assistance.

Planning. Identifying all the natural resource requirements is essential to proper planning. We all know of construction projects that have been delayed and made more costly because of a late discovery of an unresolved environmental issue.

By managing the resources on a daily basis, natural resources personnel are knowledgeable about endangered species requirements and habitat, identification of wetlands, prime and unique farmlands, sensitive habitats, and other resources requiring special protection. This specialized knowledge is available to you for the asking.

Another part of planning which can benefit from natural resource expertise is site selection for construction projects. The natural resources staff not only knows the laws, they know what is on the ground at the site of your proposed project and what natural resource problems are likely to be encountered.

A third way natural resources personnel can help in the planning process is to provide suggestions for minimizing the environmental impacts caused by a project. The natural resources manager can design mitigations for the project to reduce adverse impacts.

If you haven't discovered it already, the U.S. Fish and Wildlife Service, state fish and game agencies, wetlands boards, and many key staff personnel in Corps of Engineers offices don't speak "engineerese." The Navy natural resource professional can often translate or negotiate more effectively with the resource agencies to get project approvals. In addi-

tion, supervising the implementation of these biological projects is often the province of the natural resources personnel, since they are the long-term land managers and are the ones who must follow through with the mitigating actions.

Operations. The natural resources program has a direct role in supporting the Navy's military operations. For example, naval air stations need large undeveloped areas to provide a safe and secure buffer around runways. These lands must be maintained and preserved in some way. Secondary uses (such as crops, grazing, timber management, production of nursery stock, and natural preserves) developed through the natural resources program provide a compatible and valuable presence on the land.

Land management around airfields can also reduce expensive damage caused by close encounters of birds with high performance jet aircraft. Safety arc areas on weapons stations can be managed cost effectively to improve security, reduce wildfire hazard, and demonstrate our commitment to land stewardship.

Other operational benefits are not so easily quantifiable. Availability of outdoor recreation opportunities such as hunting, fishing, hiking, or camping improves morale and welfare and retention of naval personnel. Managing the natural resources can increase the scenic values and aesthetic appeal of the installation to both naval personnel and to the surrounding community.

Also, demonstrating to the public that the Navy is taking care of the nation's land, water, and wildlife resources is a major element in earning a good neighbor reputation and can bolster community relations.

In many areas the installation has become an island in an urban sea, and the Navy's neighbors enjoy the presence of Navy-owned natural resources and become allies in the Navy's fight to control encroachment.

Maintenance. The natural resources professional can assist in finding natural, low maintenance solutions to erosion problems. In areas where wildfires are a problem, appropriate management of the natural resources can reduce fire hazards.

The land management plan for Naval Air Station Miramar is implemented by the public works department, which uses a rangeland drill to plant clover to improve and stabilize an abandoned fire break.

The natural resources program can reduce grounds maintenance costs by landscaping recommendations and review of grounds maintenance practices. Lands which are part of the agricultural outleasing or forestry programs require no maintenance by the activity.

In addition, the proceeds from sales of forest products and outleased land pay for natural resources projects and studies Navy wide. It is also possible to use overlay refuges and other agreements to obtain help from other agencies to manage Navy lands and reduce costs.

Legal compliance and interagency coordination. Natural resources professionals can make compliance with resource protection laws easier. Navy resource specialists work closely with members of state and federal agencies to develop and manage forests, rangelands, wetlands, farmlands, wildlife and endangered species habitats.

They do this in performing inventories, conducting the Endangered Species Act consultations, negotiating and developing mitigations for landfill permits, complying with non-point source pollution (erosion) control standards, developing memoranda of understanding and the required cooperative plans between agencies, and producing and implementing natural resource management plans.

Through this process, Navy natural resource personnel have on the ground knowledge of the installation and its problems, and a good understanding of the natural resource concerns of other agencies.

A member of the team

Through resource inventories and the preparation of natural resource management plans, the natural resources professionals often have the best information about an undeveloped site.

Take advantage of this! But beyond serving as a data base, the resources professional can provide technical knowledge of solutions to natural resource problems.

Combining this familiarity with many uniquely Navy requirements and a working relationship with many of the resource agencies and their regulations, the natural resources representative is an effective member of the facilities management team. ❑

Managing Your Public Works Management Automation System Data Base

You can generate reports with the PWMA/ BEST Report Writer and the Honeywell Interactive Query Facility.

By Roy H. Chagi

What is a data base? What is data base management? These terms have become household words with the growth of computer software applications developed and marketed for the multitude of microcomputer users. How do they apply to the public works management system?

The concept of data base management isn't new. An example often used to describe one is a file of baseball cards in a shoe box. Another is receipts and documents for tax preparation stored in a shoe box. One thing is certain: as the amount of information gets larger, so does the need for a larger and more sophisticated filing system.

The infamous file cabinet, where all important documents are placed only to be lost forever, has been a mainstay of the public works data base record-keeping and filing system for years. But now, with the use of computers, space requirements for data base tracking and record-keeping have been reduced tremendously. The filing environment is also much more organized and easier to use. The computer data base improves accessibility of the stored data and the capability to quickly extract information for management or statistical reports.

The automated data base systems currently being used at nearly 75 Navy Public Works Departments (PWDs) throughout the world provide PWDs automated capability. Implementation of these systems began in late 1983 under the Base Engineering Support, Technical (BEST) program using Honeywell minicomputer systems. This system has been implemented throughout CONUS, parts of Europe, Japan, Iceland, Alaska, and Australia.

The BEST program has now been incorporated into the Naval Facilities Engineering Command's Public Works Management Automation (PWMA) Program. It supports the initial Honeywell BEST minicomputer system and the recent microcomputer version of the minicomputer programs. The PWMA system consists of maintenance/utilities, transportation, family housing, and facilities service contract modules. In addition, resource and financial management modules are under development. These PWMA applications provide the PWDs with an automated means of tracking information generated and processed in their day-to-day operation. Daily use of the system constantly adds information to or updates information in the data base.

For example, the maintenance application, which is the most widely used, tracks all the work the PWD is requested to perform. The applica-

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tion generates and stores maintenance and repair cost estimates, keeps track of emergency/service work, and a host of other information relating to the maintenance of real property. Public works managers now have the same information they used to keep in the infamous file cabinets *plus* much more in an easily accessible PWMA data base. But are we using all this information to our advantage? How can we make the most efficient use of our data base? How can you make it work for you?

By managing your data base, you can convert the stored raw data into valuable information.

Let's start by looking at a data base and a data base management system. Conceptually, it is not hard to understand. Technically, however, it can get very involved. For example, what is a relational data base? What are pointers? Indexing? Logical relationships? It can get overwhelming. It would take an expert a long time to examine and explain the detailed interrelationships of data files and data elements. Instead, this article presents data base management on a conceptual level to help you better evaluate your PWMA data base.

The Honeywell minicomputer is a familiar sight to users of the Base Engineering Support, Technical (BEST) system.

A data base is a collection of data, whether stored in a shoe box or a mainframe computer. It is more commonly thought of as a collection of files and records that contain useful information, or data elements. While simple enough, there is more to it. Relationships exist between data elements within a file that transcend the boundaries of the file itself.

An example is a library system. There are thousands of books in a library. These books can be considered as files in the data base. The entire data base is broken down by subject and alphabetically stored by author. You could process the entire data base by starting from one end of each subject and reading every book sequentially until you reach the end, or you could go directly to a subject and again go specifically to a book if you knew the author. But look again, each book contains footnotes and references which also serve to establish relationships between various books and various information within a book itself. Relationships such as these add to the complexity of the data base. However, it is this type of multi-file relationship which makes it possible to store different kinds of related data in separate files, cross-reference them, then easily retrieve them in various formats as desired.

It should be obvious that even if a data base exists, nothing is served or gained unless someone acts upon it. Only then does it become meaningful information. This process of acting upon the data base by inputting, retrieving, and manipulating data is collectively taken to form the basic elements of a data base management system.

In the library example, the card catalog would be a basic element of

its data base management system. It represents the retrieval and manipulation of certain selected data elements that are intended to help library users. As in the library, the PWMA system is designed to store specific information in specific files in its data base.

It is therefore critical for users to make sure that the correct information is consistently entered in the right places. Without this caution, retrieval of information can produce incomplete, inaccurate, or even invalid results.

Reports generated

Most commercial data base managers offer a capability to generate customized reports and extract information quickly from the data base. Similarly, the PWMA system has the capability to generate reports.

The Honeywell minisystem has two report generators—the Honeywell PWMA/BEST Report Writer and the Honeywell Interactive Query Facility (IQF). The PWMA/BEST Report Writer is a simplified menu driven version of the IQF. It is simpler to use and can generate almost any type of management report. User manuals have been written for it, and most of the PWDs have already discovered the benefits of using this Report Writer.

The PWMA micro-application uses a commercial software called the Xtrieve File Management Report Option Program. It is a menu-driven application similar to the Honeywell PWMA/BEST Report Writer.

The other version of the Honeywell mini-report generator, the IQF, uses a collection of command statements much like a program. It is also a little more complicated to use than the PWMA/BEST Report Writer. Menus are simpler to use than a command program but are generally less flexible.

Those PWMA/BEST personnel at the Engineering Field Divisions (EFDs) and a few at the PWDs who are able to use the IQF version have attended formal Honeywell classes to gain this expertise. Hold on a second! I'm not suggesting that you all run to your Honeywell Education Centers and sign up for these classes. Quite the contrary.

With all this expertise available at your neighborhood EFD, all you have to do is call the EFD for help. If the desired report is simple enough, it may be designed and developed at the EFD and mailed out to your activity. If it is more complex, the EFD personnel may have to visit your site, collect more data, design the report, and finally test the report at your activity.

Another option is to find out if your EFD sponsors any training sessions on the use of the Honeywell IQF, the Honeywell PWMA/BEST Report Writer or the micro-application Xtrieve Report Writer. If it does, call for the schedule and sign up. In response to requests from activity personnel, the Western Division, NAVFAC has offered training sessions on the use of the Honeywell PWMA/BEST Report Writer and the IQF, and in developing customized reports.

By managing your data base, you can convert the stored raw data into valuable information. Managers will always require generation and retrieval of information, but with the PWMA/BEST system, you can get it done faster. It will provide improved capability to solve problems and make informed and responsive decisions. The better we understand the PWMA/BEST data base, including a few basic concepts of data base management, the more useful and helpful our PWMA/BEST system becomes. ❑

Editor's Note: See page 27 for a related article on PWMA.

The Pressure Vessel Inspection Program

NAVFAC is placing increasing emphasis on the proper procurement, operation, maintenance, and inspection of pressure vessels.

By Johnny R. Johnston

This article addresses the three major elements in the pressure vessel inspection program—the pressure vessel (fired and unfired), the equipment operator, and the inspector.

What is a pressure vessel?

A pressure vessel is simply a vessel constructed to maintain its contents above or below atmospheric pressure. Examples are a steam boiler, hot water heater and an air receiver. Every shore facility, without exception, has pressure vessels. They might be behind the mess hall, in the basement of the chapel or in the service station garage, but they are out there and they're dangerous.

Would the American Society of Mechanical Engineers (ASME) produce an 11-volume set of manuals for their design and construction if they weren't? Would the National Fire Protection Association devote more than 20 codes and standards to their installation? Why would almost every state in the union have rules and regulations for pressure vessel care, operation and inspection?

The regulations exist because pressure vessels have the potential to kill and maim. Have you thought about the pressure vessels on your facility, or do you even know how many are out there and where they're located? You might even be sitting next to a pressure vessel located in a mechanical room next to your office and not even know it. But I can guarantee it will get your attention though, if it bursts.

Pressure vessels are divided into two major groups, fired (a boiler, for example) and unfired (such as an air receiver). Both have subgroups and classifications based upon their use, design, operating pressure, construction and size, to name a few. For our discussion of the safe in-service operation of pressure vessels after their installation, we will use the general categories shown in Tables 1 and 2. All vessels falling outside of the shaded portions require specialized safety inspections to obtain a certificate to operate, and some require special environmental permits. Fired pressure vessels also require special operator qualifications.

There are currently more than 1,800 boilers and 3,500 unfired pressure vessels (UPVs) in the Western Division, Naval Facilities Engineering Command (WESTDIV) inspection program.

One area of major concern to the managers of the pressure inspection program is the presence of non-code vessels. These are any pressure vessels that require certification under the program parameters but lack any identifying markings to indicate they were constructed under a quality assurance program. A pressure vessel which is neither Military Inspection (MILSPEC) or ASME stamped may only be certified when design drawings and engineering calculations are available to the inspector to positively determine whether the vessel is safe to operate.

The inspector may also ask for non-destructive testing such as ultrasonic measurements and radiography of welds or destructive testing of a representative vessel before issuing a certificate of safety.

We still see activities purchasing non-code pressure vessels. However, given that the costs of performing the previously mentioned tests generally exceed the monetary value of a non-

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coded vessel, it makes good economic sense to procure properly coded vessels.

When procuring a new pressure vessel make sure your specifications will provide units constructed for the specified design conditions and performance requirements in accordance with the ASME Boiler Pressure Code. NAVFAC guide specifications should be used where appropriate.

Pressure vessel operators

Until recently, plant operator qualifications and standards were not a major component of the in-service inspection program. The plant operators were qualified to operate the equipment under their cognizance, allowed to make the minimum required attendance visits to check the equipment, and fairly stable in their employment. That was yesterday. That was before the "black box controls" era, before the budget cuts, and before the Commercial Activities Most Efficient Organizations.

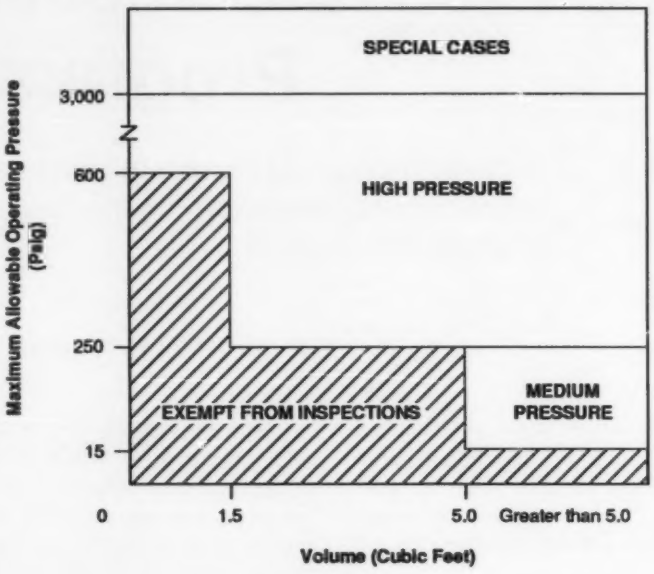
Reality is having less than fully qualified operators tending the equipment, skipping required attendance visits for lack of personnel, and operating without monitors, controls and recorders that are either inoperable or bypassed.

Since we put our name on the certificate saying, in effect, that a particular pressure valve is safe to operate, we have a vested interest in how the operator maintains, manages, and operates it.

So far the larger power plants haven't been a problem. They are still staffed to at least a minimum standard. It's the smaller satellite (remotely located) boilers that are causing us to question whether to certify a unit as safe to operate.

We're finding many of the plants are not getting the minimum attendance in conformance with NAVFAC Instruction 11300.37 (Energy and Utilities Policy), particularly after

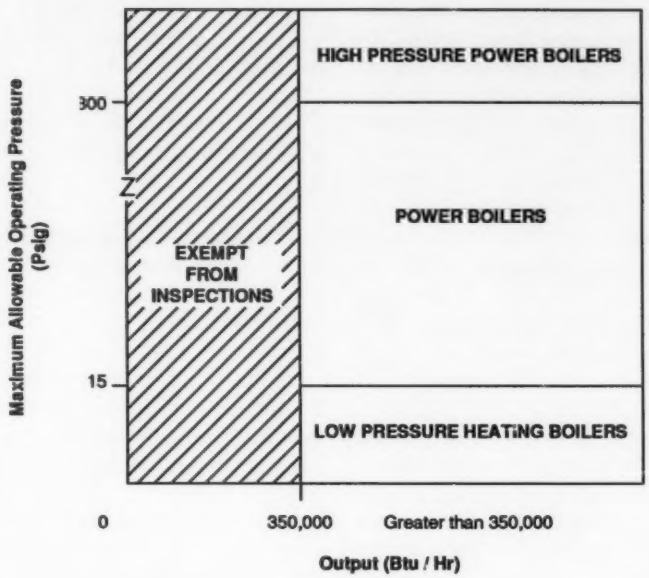
Table 1.
Unfired pressure vessels (UPVs) requiring safety inspections.



Exemptions

1. Cylinders for shipment of compressed or liquefied gases.
2. Air tanks for air brakes on vehicles.
3. Unfired pressure vessels operating at an internal or external pressure not exceeding 15 pounds per square inch gage (psig) with no limitation on size.
4. Unfired pressure vessels having a volume of less than 5 cubic feet and design pressure less than 250 psig or volume of less than 1.5 cubic feet and a design pressure less than 600 psig.
5. Unfired pressure vessels containing only water under pressure at ambient temperature for domestic or industrial process supply purposes, including those containing air, the compression of which serves only as a cushion.
6. Unfired pressure vessels used as refrigerant receivers for refrigerating and air conditioning equipment.
7. Fire extinguishers.
8. Shore based hyperbaric facility pressure vessels used for manned operations or for testing animals or equipment. (Gas storage flasks, volume tanks, fire water tanks, and filters with a cross sectional internal dimension in excess of 3 inches are covered.)

Table 2.
Fired pressure vessels (boilers) requiring safety inspections.



Exemptions

1. Coil type steam vapor cleaners unless requested by the activity.

2. Unit heaters (gas, electric, or steam).

3. Boilers under 350,000 Btu/hr output capacity unless requested by the activity.

4. Water heaters for domestic hot water service at temperatures not exceeding 211° F in galleys, bakeries, laundries, hospitals, laboratories, quarters, and other buildings and structures. This equipment comprises either an integral heater and storage tank or a separate heater and tank.

5. Residential and commercial warm air furnaces.

hours, and that many of the watchstanders tending the boilers are not aware of all the aspects of safe operation. Watchstanders for even the smallest low pressure boilers should be able to do the following:

• Explain the functions and operation of all controls on the boiler or boiler.

• Be able to light off the boiler or boilers in a safe manner.

• Know all possible methods of feeding water to the boiler or boilers.

• Be able to blow down the boiler or boilers in a safe manner.

• Know what would happen if the water was permitted to drop below the lowest permissible operating level.

• Know what would happen if the water in the boiler was carried too high.

• Know how to shut down the boiler or boilers.

Currently, there is a NAVFAC proposal to require Navy stationary boiler operators to be licensed. Many states and some cities require this now, although it doesn't affect operators on military reservations. The consensus among the inspectors is that licensing will at least give us a benchmark in judging an operator's qualifications for assuming responsibility for the equipment. It will also allow us to identify by equipment type and classification the level of operator license required for its safe operation. No formal standard exists for those who can or can't operate high pressure unfired pressure vessels.

Pressure vessel inspectors

The Maintenance and Operations manual NAVFAC MO-324 (Inspec-

tion and Certification of Boilers and Unfired Pressure Vessels) covers the policies and administrative procedures for pressure vessel inspection and certification.

It says that any vessel requiring the inspection (usually annually for fired pressure vessels and every two years for UPVs in the program) must be inspected by a qualified inspector. It goes into detail as to what constitutes a qualified inspector and also delineates options for obtaining inspection services. The three options are:

- Use an in-house inspector.

- Borrow an in-house inspector from another activity or EFD.

- Contract for the service.

To become a certified naval shore facilities boiler and unfired pressure vessel inspector requires passing the same national board exam given to the state and insurance inspectors and having the required practical experience and education.

WESTDIV currently has more than 30 certified inspectors registered on its rolls. Since contracted inspection services are averaging $200 to $1,300 for a boiler inspection and $80 to $250 for a UPV inspection (includes travel, per diem, profit, etc.), many activities find it cost effective to have their own in-house inspector.

In addition to providing the annual in-service safety inspections, the inspectors also assist the resident officer in charge of construction (ROICC) by observing performance tests on new installations and by providing technical expertise during the pressure vessel acceptance inspection. Having the inspector on site during the acceptance testing serves two purposes.

One, the inspector can advise the ROICC on technical matters and verify that the boiler and/or UPV construction and installation are in accordance with the contract and codes.

Second, the inspector can witness the testing being done by the contractor, which can save time and money when it comes time for the inspector to certify the boiler for operation by the Navy.

Many of the tests, such as hydrostatically testing the boiler, are required of both the contractor and inspector and need be conducted only once if the inspector is present.

Make your inspector happy

To keep your inspector happy, take these few simple steps:

- Don't let the pressure vessel operating certificate expire before calling in the inspector.

- Have an accurate inventory of your equipment and inspection requirements so the inspector can schedule inspections accordingly.

- Don't purchase a non-code vessel and expect the inspector to certify it.

- Give the inspector a copy of the new construction project drawings and specifications to review before the inspector comes on site.

- Make sure your boiler operators are qualified and making the at least the minimum number of attendance visits to the pressure vessels.

- Properly prepare the vessel for inspection. The boiler temperature must be low enough to ensure that inspecting personnel will not be exposed to excessive heat.

Before internal inspection is done the owner/user must determine that the boiler/vessel is safe to enter, is adequately ventilated, and contains no harmful vapors. If a boiler/vessel has not been properly prepared for inspection, the inspector may decline to proceed. ❑

Challenge: Maintain Military POL Storage Facilities In Japan

By LT Willington Lin, CEC, USN

The lifeblood of our defense forces is the fuel that drives our ships, flies the aircraft, and powers the vehicles. Maintaining the daily flow of fuel to sailors, soldiers and airmen is a challenge in facilities engineering management and maintenance.

Background

In Japan, the U.S. Navy is responsible for storing and providing POL (petroleum, oil, and lubricants) products for all U.S. government activities. These POL storage facilities comprise the largest fuel storage system in the U.S. military and represent almost three-quarters of all military storage in the Western Pacific. The Western Pacific region contains the military force structure supporting the Seventh Fleet, the U.S. Eighth Army in Korea, the Third Marine Expeditionary Force (MEF) in Okinawa, the Fifth Air Force in Japan as well as additional forces in the Philippines and other Southeast Asia countries. More than 100,000 servicemen and women in an area encompassing one-fifth of the globe are supplied by these POL facilities. Keeping these POL facilities in ready service is critical to fulfilling Department of Defense mission requirements in the Far East.

The U.S. Naval Supply Depot (NSD), Yokosuka operates and maintains these POL storage facilities. NSD, Yokosuka operates seven fuel terminals in Japan organized under two detachments, Tsurumi and Sasebo. The total fuel storage capacity maintained by NSD is about 11 million barrels—more than 400 million gallons.

Most of the POL storage facilities were constructed in the 1930s for the Imperial Japanese navy. The U.S. military received control of these POL facilities after World War II. Originally operated by the U.S. Army, in 1971, the U.S. Navy and NSD, Yokosuka assumed responsibility of operations and maintenance for all U.S. military bulk POL storage facilities in Japan.

The Officer in Charge of Con-

Figure 1. Top of existing underground tank with buried roof.

LT Willington Lin is a graduate student at the University of Illinois. At the time he wrote this article, he was the assistant resident officer in charge of construction at Naval Facilities Engineering Command Contracts, Far East in Yokosuka, Japan. LT Lin is a professional engineer registered in Minnesota.

struction (OICC), Far East located in Yokosuka, Japan, performs the design and execution of most POL repair projects for NSD, Yokosuka.

The vast majority of these fuel tanks were constructed with blast resistance and camouflage protective measures. Most fuel terminals have large underground POL storage tanks completely hidden from sight by earth embankments sometimes 2 feet thick. The aboveground tanks at some fuel terminals have huge, thick concrete blast walls around each tank.

These tanks range in capacity from a few thousand gallons to more than 300,000 barrels each. Most tanks are cylindrical, with fixed roofs. Some tanks are up to 290 feet in diameter and more than 100 feet deep.

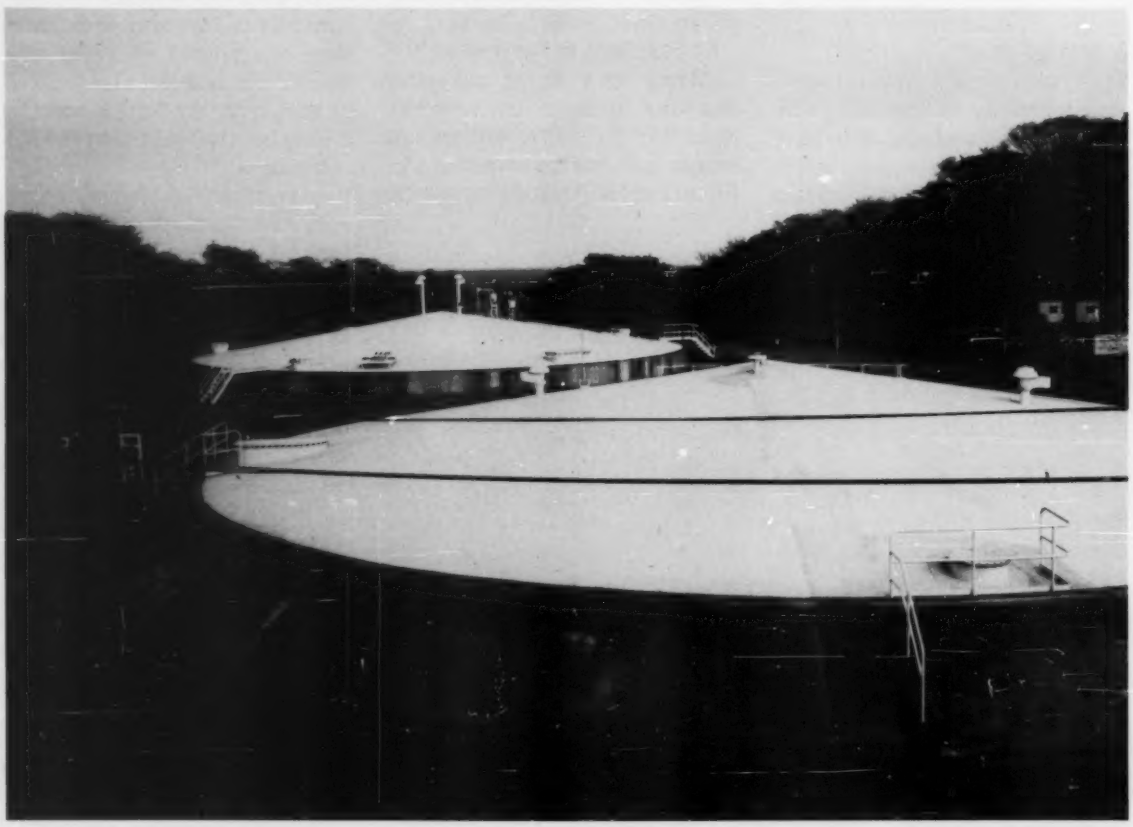
Two common types of underground tanks were constructed. Smaller tanks, about 30,000 barrels capacity, were built with reinforced concrete walls and bottoms. Larger tanks, about 130,000 barrels and larger, were built with large steel shell plates riveted together on a concrete backing (Figures 1 through 3). The tanks were constructed for storage of heavy fuel oil burned by ships.

Incomplete maintenance records were kept on these POL tanks until the U.S. Navy assumed responsibility for the POL facilities. Available records showed that little or no maintenance was performed on these fuel tanks from 1945 until 1971. Some storage tanks have had no maintenance or repairs performed from 1945 until today, and it's doubtful any major repair work was carried out during World War II. Evidently, these tanks were in service, in some cases more than 50 years, with little or no maintenance.

The types of fuels stored in these tanks gradually changed over the years. Heavy fuel oils, such as Bunker C and Navy Special Fuel Oil (NSFO), were replaced by jet fuel. The fuel oils were very viscous and acted as sealants for small tank leaks. Aviation jet fuels such as JP-4 and JP-5 are much lighter and more volatile than most fuels. The change in fuels eliminated the sealant effect provided by the heavier fuel oil.

Although only minor leakage was encountered with heavy fuel oils, large amounts of tank leakage was discovered upon introduction of jet fuels. By 1970, more than half the total usable

Figure 2. Top of existing underground tank with exposed roof.



storage capacity was out of service. An additional 15 percent of capacity was only partially usable.

Earth embankments on the tanks were removed during the 1950s and 1960s for unknown reasons. The earth embankments were camouflage and insulation for the concrete roof slabs. Severe deterioration and weathering of concrete roof slabs caused severe cracking and spalling. Many roof slabs leaked rain water and also allowed fuel vapors to escape. The roof slab leakage created a dangerous environmental and fire hazard.

These POL facilities lie adjacent to major waterways used by millions of civilians and, in some cases, are surrounded by civilian communities. Stringent environmental and safety standards combined with the deteriorating conditions prompted a thorough review of these POL storage facilities.

Meeting the challenge

In 1981, Pacific Division, Naval Facilities Engineering Command began a detailed and comprehensive review of POL storage facilities in Japan, known as the MILPOL-Japan study. This report by Dravo Van Houten, Inc., consulting engineers from New York, was completed in 1984. Many recommendations on improvements and upgrades were presented to the Pacific Division to enhance the capabilities and operability of the military POL storage facilities in Japan. The major item of concern identified by the report was the deteriorating condition of the POL storage tanks.

Since the tanks were constructed, numerous technological advances have been made in POL storage tank design and operations. The American Petroleum Institute (API) and the Naval Facilities Engineering Command Design Manuals, notably DM-22, prescribe guidelines for safe, proper and environmentally sound operation of POL facilities. (Figures 4 and 5 show some of the improvements needed to bring the tanks up to standard.)

The MILPOL-Japan study had anticipated that some underground tanks could have the seams and rivets sealed if the tank conditions allowed. But, the tanks' increasing age and deteriorating conditions have resulted in a

Figure 3. Tank interior under repair.

need for the complete relining of these tanks.

Environmental protection is a top priority and new POL tank linings and coatings should guarantee no leakage for many years. New coatings using aerospace technology are now used in the tanks. The Naval Research Laboratory and the Naval Facilities Engineering Command are jointly involved in developing new methods of repairing POL tanks and testing new coating systems.

However, the solutions pursued in resolving these challenges have not come error free. Innovative engineering ideas and plans have been countered by economic limitations and technology improvements. These limitations were encountered in the sealing of rivets in the POL tanks.

Several methods of sealing the rivets were developed for tank repairs in the 1970s. One method was to weld steel angles over the rivets and seams and to coat the entire tank with a epoxy coating system. Another method was to cover the seams and rivets with a fiberglass reinforced epoxy compound and then overcoat with an epoxy coating system.

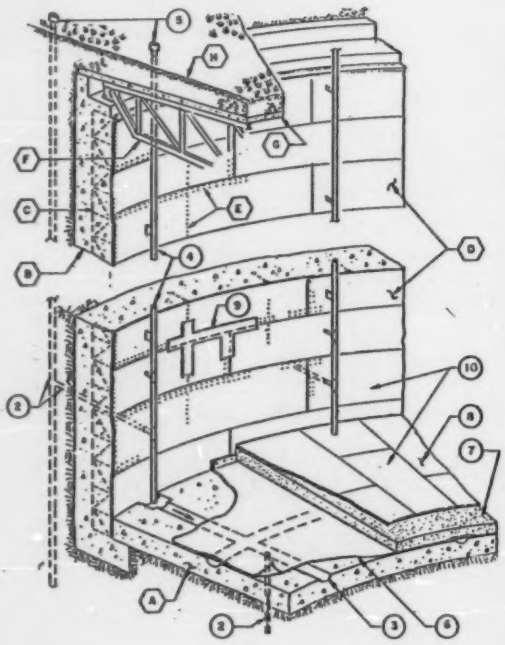
The repairs performed with these methods are only partially successful. The welds for the steel angles were breaking due to tank flexure and the fiberglass reinforced epoxy become brittle over time and developed cracks. These methods developed leaks only a few years after completion of repairs. Although these methods were economical compared to new steel liners, they are more costly in the long run, as repairs need to be made more frequently.

The new coating and sealing materials were not tested under the environmental conditions inherent to Japan's climate. The top coat of a newly developed five-part coating and sealing system was not bonding to other coats.

This new system, using fuel tank sealers developed for the aerospace industry, was specified for repairs to five large (200,000 barrel) jet fuel tanks. The first tank using this new method developed this delamination problem.

Resolution required close coordination between the construction office, designers and the coating manufacturers. The incompatibility was resolved by changing to a compatible

Figure 4. General concept for repair of underground POL storage tank with repair of existing wall liner.



Existing Components

- (A) Concrete bottom
- (B) Concrete wall
- (C) Steel trusses
- (D) Steel plate liner
- (E) Rivets
- (F) Steel roof trusses
- (G) Concrete roof
- (H) Earth cover

New & Modified Components

1. Deactivate, clean and vapor free tank
2. Groundwater drainage holes and wells
3. Floor trenches and sumps
4. Groundwater collection pipe system
5. Drainage system inspection hatches/vents
6. Impermeable flexible liner
7. Sand base cushion
8. Steel plate bottom liner
9. Fiberglass reinforced epoxy (FRE) lining system
10. Epoxy coating bottom

NOTE: Repair concept developed by Dravo Van Houten, Inc., for repair of various underground POL storage tanks under contract to U.S. Navy OICC, Far East.

top coat material that would bond with the other coats.

Conclusion

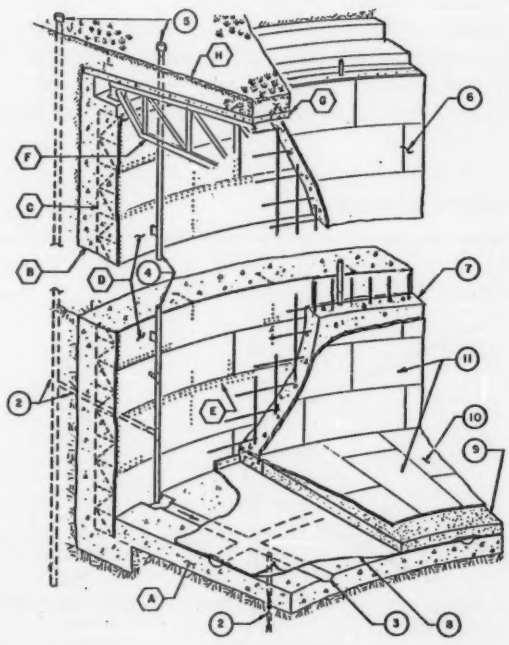
Managers of fuel terminals, military or civilian, around the world undoubtedly have similar challenges in maintaining POL facilities constructed during World War II. As these tanks and fuel systems exceed their 50-year anniversary, greater emphasis is needed on POL facilities management. The increasing costs and strategic value of fuels will place more importance on proper maintenance of our existing POL facilities. Stringent safety and environmental requirements will put POL storage facilities in the forefront of the concerns of facility and public works managers.

The Officer in Charge of Construction, Far East, the Naval Supply Depot, Yokosuka and Commander, U.S. Forces, Japan have developed a POL facilities maintenance and construction data base. The concepts and lessons learned are applicable to all POL facility managers. The Naval Facilities Engineering Command, with the Technical Information for Problem Solving (TIPS) program, has also collected data on POL facilities.

Most problems with POL facility repairs can be prevented by practicing a few basic tips. First, construction data bases need to be consulted during design for previous problems. The costs involved in resolving design problems during construction is much, much higher than the few days required during design to review construction and design data bases. Second, economics of planned repairs should be compared to other options, including complete reconstruction. Costs of performing repairs on a 10-year life cycle may exceed replacement on a 20-year cycle. Lastly, but most importantly, consider if the repairs make sense. Use a repair method that works. No one will benefit from poor planning or designs. But everyone will benefit from environmentally sound, cost efficient management of our fuel resources. ❑

I would like to thank the U.S. Naval Supply Depot, Yokosuka and its Fuel Department and especially LT Russ Thackston, CEC, USN, staff civil engineer, for his help in researching this article. - *LT Willington Linn*

Figure 5. General concept for repair of underground POL storage tank with a new wall liner.



Existing Components

- (A) Concrete bottom
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- (E) Rivets
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- (G) Concrete roof
- (H) Earth cover

New & Modified Components

1. Deactivate, clean and vapor free tank
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7. Reinforced concrete wall
8. Impermeable flexible liner
9. Sand base cushion
10. Steel plate bottom liner
11. Epoxy coating bottom

NOTE: Repair concept developed by Dravo Van Houten, Inc., for repair of various underground POL storage tanks under contract to U.S. Navy OICC, Far East.

Contract Modification Terminology: Do You Know What You're Saying?

By LT Chris Roth, CEC, USN

• A modification to a contract, signed by both parties and within the general scope of the contract, is *not* a change order.

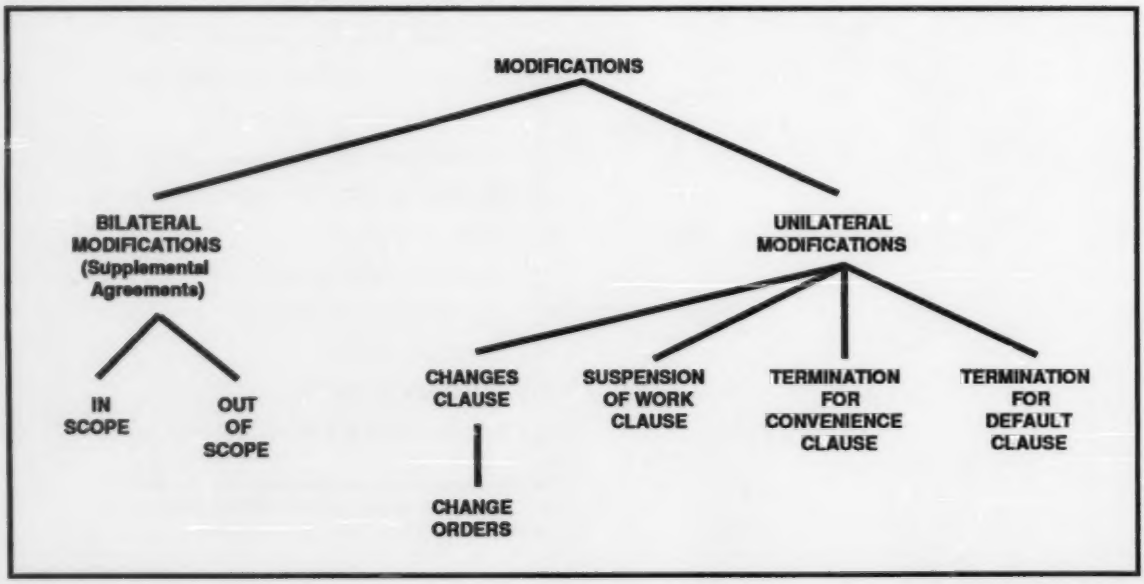
• The term *supplemental agreement* applies to modifications that are within scope as well as out-of-scope.

• A Notice to Proceed is no longer used for modifying contracts.

If you are surprised by the above, you are not alone. In the past, the Naval Facilities Engineering Command (NAVFAC) has given these terms (modification, change order, supplemental agreement, and Notice to Proceed) different meanings than provided in the Federal Acquisition Regulations. The push is on at NAVFAC to use FAR terminology when it comes to contract modifications.

A contract modification is any written change in the terms of the contract. There are many ways to categorize modifications but the most useful for this discussion is to categorize modifications, or mods, as

Figure A. Contract modifications can be categorized as either bilateral or unilateral.



either bilateral or unilateral. A chart that categorizes the types of mods is provided in Figure A.

A bilateral modification is a contract mod signed by the contracting officer and the contractor. Both parties agree to the terms of the modification.

The term *supplemental agreement* is used interchangeably in the FAR with bilateral modification. There is no distinction between in-scope and out-of-scope. Any modification signed by both parties is a supplemental agreement.

A unilateral modification is a modification signed only by the contracting officer. There does not have to be any concurrence or agreement by the contractor. One party directs the other party. In our contracts only the government has the entitlement to give unilateral direction.

There are a number of clauses in our contracts that give the government the right to direct a contractor without his consent. The major ones are the Changes clause, the Suspension of Work clause, the Termination for Convenience clause, and the Termination for Default clause.

Powerful tool

These clauses provide the government with a powerful tool. NAVFAC does not need to get the contractor's consent to suspend a portion of the work. The Suspension of Work clause allows us to do this unilaterally. Under the Termination for Default clause, we do not ask the contractor to agree to be terminated. We inform the contractor the contract is terminated and direct the contractor to stop work.

The push is on to use FAR terminology when it comes to contract modifications.

In a sense we do have the contractor's agreement for these unilateral actions. When signing the original contract, the contractor agrees to comply with all the provisions of the contract. Included in the contract are the clauses mentioned above. The contractor gave us the right to take unilateral action under these clauses when the contract was signed.

Changes clause

The clause most often used by NAVFAC to take unilateral action is the Changes clause. The Changes clause gives the contracting officer the right *at any time, without notice to the sureties*, and *by written order indicated to be a change order* to make changes within the general scope of the contract.

Notice the term *change order*. FAR states a change order means a written order, signed by the contracting officer, directing the contractor to make a change that the Changes clause authorizes the contracting officer to order. Furthermore, the change order is issued without the contractor's consent. A change order is a unilateral modification issued under the Changes clause.

The definition above mentions "without the contractor's consent." That is why a modification issued *with* the contractor's agreement is not a change order. If the contractor agrees, it falls under the definition of a supplemental agreement. So any modification signed by both parties, whether in-scope or out-of-scope, is a supplemental agreement. Does this mean we should not be concerned about the scope of the modification? The answer is no. We are very concerned about scope. The Changes clause allows us to direct a contractor unilaterally but only on *work within the general scope of the contract*. If the work is out-of-scope, we lose our right to take unilateral action.

Does this mean a contractor cannot do work outside the scope of the contract? The answer again is, no. We can get the contractor to do out-of-scope work but only if he agrees to do it.

The modification would require the contractor's and the contracting officer's signatures. Such a modification would therefore be a supplemental agreement.

There is more to be considered when doing an out-of-scope modification than whether the contractor consents to do the additional work. The FAR treats out-of-scope work as a new procurement.

You must follow all the procedures and obtain all the approvals

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LT Roth is an instructor for the Advanced Contract Management course at the Naval Facilities Contracts Training Center in Port Hueneme, Calif.

required for any sole source procurement.

Notices to Proceed

The last point of discussion is about Notices to Proceed. The letters NTP are no longer used by the Naval Facilities Engineering Command. The NTP document did not have a basis in the FAR, which raised questions concerning its contractual validity.

However, the situation which led to the use of the NTP remains. The contracting officer must be able to direct the contractor when there is not enough time to execute a forward priced supplemental agreement. This is now done under the Changes clause by issuing a change order.

Loosely put, the NTP has been replaced by the change order. There is no question that a change order is a valid contract document. It, like any contract modification, is issued on a SF 30. The contractor must comply or risk termination for default.

To summarize:

- Any mod signed by the contracting officer and the contractor is a *supplemental agreement.*
- Any mod signed by only the contracting officer is a *unilateral modification.*
- A unilateral modification issued under the Changes clause is a *change order.*

The NAVFAC community should start using the FAR terminology for contract modifications. Using FAR terminology will bring us in line with other government procurement agencies and reduce needless confusion. ❑

Who Is Responsible for Quality Control?

By LT Stephen T. Eckel, CEC, USN

Who is responsible for quality control (QC)? Federal Acquisition Regulation (FAR) subpart 46.105 says that the contractor is responsible for quality control. The obvious reaction is, "Isn't that putting the fox in charge of the hen house?" Well, true or not, the contractor is still charged with quality control.

Here's another way to look at the situation. When you purchase a car, do you want to be in charge of QC or would you prefer that the car manufacturer be responsible? Understand that if you decide to take responsibility for QC, it will be up to you, the buyer, to find the problems and have the manufacturer take care of them. Aren't you more pleased with an automobile manufacturer that sells you a car with no defects rather than one with defects? The government should expect—and demand—that the products it purchases are delivered free from defects.

The next question is, how does the buyer know that the QC system is working or has worked properly? Counting defects at delivery is one way, but we want a usable product at delivery, not one which goes back for repairs. A better method is to establish that the QC system functions as designed to deliver a product free from defects.

How does the government manage the contract and make sure the contractor's QC system is working properly? Contracts for construction or facilities support require the contractor to prepare a QC plan.

In the case of design contracts, certain EFDs are requiring architect-engineer firms (A-Es) to prepare design quality control plans. These plans outline the process and procedures that the A-E contractor will take to ensure that the plans and specifications are reviewed, checked and coordinated. The degree of the QC plan's sophistication depends upon the size or complexity of the work. The key to a successfully delivered product is good QA (quality assurance) by the government—making the QC system work.

LT Eckel is director of the Facilities Acquisition Division of the Naval School, Civil Engineer Corps Officers in Port Hueneme, Calif. He is a registered engineer in North Carolina.

Use of proper QA procedures ensures that the QC plan describes in detail what the government representative must check. The plan must be specific and say more than, "We will provide all of the work in accordance with the drawings and specifications." The contractor's signature on the contract already says that.

Let's look at an example. The placement of reinforced concrete requires that formwork, reinforcing steel, and tolerances be checked before wet concrete is placed into the forms. An oversimplified, difficult-to-manage-from plan might say, "Place concrete after the QC representative has checked the work." This is of little use for someone trying to monitor the QC program or for the QC personnel. A better entry in a well-written plan might be:

Placement of Reinforced Concrete

a. Formwork. Placed in accordance with shop drawing XYZ. Mortar-tight as required by spec XYZ.

b. Reinforcing steel. Tolerance 2 inches as required by spec XYZ. Check that the steel is tied as required by spec XYZ.

c. Concrete. Check slump of delivered concrete. It should be 4 inches per spec XYZ.

d. Testing. Initial testing requires taking test cylinders, two per truckload.

e. When QC has determined items "a" through "d" check satisfactorily, the concrete may be placed.

Now, when QA personnel arrive in the field, they know the specific standard QC people are supposed to check against when placing reinforced concrete, and they can make sure those standards are met. Generalized statements are difficult to check. A specific QC plan allows everyone to know exactly what the expected standards are and what *specific steps* must be taken to get there. ❑

Quality control inspectors make sure the reinforcing bar mat (rebar) has been properly placed before pouring the concrete.

Asbestos to Be Banned by 1997

The EPA-imposed ban will take place in three stages, starting this year.

By Michael F. Larson

Stage One Products

Flooring felt
A/C Corrugated sheet
Roofing felt
Vinyl/asbestos floor tile
Pipeline wrap
Asbestos clothing
A/C flat sheet
New asbestos containing products

Stage Two Products

Beater-add gaskets (except specialty industrial gaskets)
Sheet gaskets (except specialty industrial gaskets)
Clutch facings
Automatic transmission components
Commercial & industrial friction products
Drum brake linings (OEM)
Disc brake pads (LMV) (OEM)

Stage Three Products

A/C Pipe
Roof coatings
Commercial paper
Non-roof coatings
Corrugated paper
Brake blocks
Rollboard
Drum brake linings (AM)
Millboard
Disc brake pads (LMV) (AM)
A/C Shingle
Disc brake pads (HV) (AM)
Specialty paper

A/C	Asbestos/cement
(OEM)	Original equipment market
(AM)	After-market
(LMV)	Light & medium vehicles
(HV)	Heavy vehicles

Figure A. Asbestos products will be banned in the three stages.

On July 6, 1989, Environmental Protection Agency (EPA) Administrator William Reilly announced plans to ban virtually all uses of asbestos by 1997. The ban will prohibit the importation, distribution, manufacture and processing of asbestos.

Reilly called the ban "pollution prevention" because it eliminates a known cancer-causing substance from the marketplace. EPA estimates the ban will cost consumers about $460 million over the next 13 years, mostly in the form of higher prices for substitute materials. It will save an estimated 200 lives. According to the Associated General Contractors, the ban could lead to shortages of construction materials in certain parts of the country.

The final rule published in the July 12, 1989, Federal Register was issued under authority of the Toxic Substance Control Act (TSCA). The final rule announces the ban will occur in three stages to allow industry time to develop substitutes.

The first stage, which takes effect in 1990, will ban such items as pipeline wrap, roofing felt, vinyl-asbestos floor tile and certain asbestos-cement products. By 1993, asbestos-lined vehicle brake systems will be prohibited. Three years later, the ban will cover the use of roof and non-roof coatings, asbestos/cement (A/C) pipe and shingles, and other asbestos friction products. (See Figure A for a complete listing of all the banned items.)

Remaining stock-on-hand of an affected product must be disposed of within six months of the effective date of the ban on distribution in commerce.

Products that are subject to a current or future ban on manufacturing, processing, import, or distribution in commerce must be labeled by manufacturers, importers, and processors according to the schedule in Figure B. This label is required:

> Notice—This product contains ASBESTOS. The U.S. Environmental Protection Agency has banned the distribution in U.S. commerce of this product under Section Six of the Toxic Substance Control Act (15 U.S.C. 2605) as of (insert the effective date of ban on distribution in commerce). Distribution of this product in commerce after this date and intentionally removing or tampering with this label are violations of federal law.

Michael F. Larson is an environmental engineer with the Environment, Safety, and Health office at the Naval Facilities Engineering Command in Alexandria, Va.

Ban on Manufacture, Import, and Processing	
Stage One	Aug. 27, 1990
Stage Two	Aug. 25, 1993
Stage Three	Aug. 26, 1996
Ban on Distribution in Commerce	
Stage One	Aug. 25, 1992
Stage Two	Aug. 25, 1994
Stage Three	Aug. 25, 1997
Effective Dates for Labeling	
Stage One	Aug. 27, 1990
Stage Two	Aug. 25, 1992
Stage Three	Aug. 25, 1995

Figure B. Important dates in the asbestos bans.

Labeling will be required

Navy personnel will be required to label the inventory stock of asbestos ingredient products. Asbestos ingredient products are asbestos-containing materials that will subsequently be processed into an altered state (for example, asbestos-containing powder used to produce pyrolock and its application as a chamber coating). "Asbestos ingredient products" does not pertain to final form products such as A/C pipe and vinyl asbestos floor tile.

The final rule allows EPA and the Department of Defense to establish mechanisms for dealing with asbestos-containing products used for military-unique applications. A Memorandum of Understanding between the two agencies will be developed, with the Naval Sea Systems Command taking the lead. ❑

Strategic Information Planning for the 90s

By Don Allen

The Navy is facing significant change in the way it performs its mission. The economic environment is unpredictable, and waste in productivity must be reduced. Total Quality Management (TQM) gurus claim a 30 percent waste exists in most organizations, and productivity studies document ranges from 15 percent to 60 percent waste.

Public works organizations must become more competitive if they are to survive the 90s. The challenge faced by today's public works managers is how to manage a dynamic work force environment with diminishing resources. Information management is part of the solution to this dilemma.

Strategic information planning provides the tools to manage and use information. The "value added" of strategic planning creates a linkage between information system plans and business plans to provide a structure for management of an organization's information resources.

In a nutshell, major components of a strategic plan are the business model, which defines functions performed independent of organizational structure. This model describes processes that create, update, or use information. At a more detailed level the *data architecture* identifies information requirements and relationships.

Next, the *applications portfolio* and *technology architecture* provide a profile of existing software applications and document equipment configuration(s), respectively.

Several matrices are generated that relate functions, systems, and organizational components. Based on these components, an *implementation plan* is developed providing the basis for short and long range public works information system plans. The plans make sure information requirements for both management and operational needs are addressed.

Execution of typical implementation plans results in efficient automated systems with the least investment. It also shifts focus of automation from technology to information needs. The data architecture identifies the need for, and supports, integration with other information systems. Most importantly, this process enables management to take control of the organization's information resource.

The *Public Works Information Architecture (PW ARK) Project*, sponsored by the Naval Facilities Engineering Command, is developing a generic public works business model, data architecture, and other strategic planning products that support public works organizations. PW ARK products will provide direction in developing policy and guidance for future public works management automation (PWMA) efforts. Results of this project will be made available to major claimants and activities interested in strategic planning. ❑

Don Allen is the public works management automation program manager at the Naval Facilities Engineering Command in Alexandria, Va.

Southwest Division, NAVFAC's newest EFD, resumes official operations

By Jeanne A. Light

Nearly 20 years after a consolidation of its predecessor command resulted in the transfer of people and functions from San Diego to San Bruno, Calif., the Navy's seventh and newest Engineering Field Division (EFD)—Southwest Division—has resumed official operations.

Formal dedication ceremonies were held Sept. 29, 1989, at the command's 1220 Pacific Highway headquarters to celebrate the official organizational change which went into effect Oct. 1. On hand for the ceremony was Rear Admiral Benjamin F. Montoya, then-Commander of the Naval Facilities Engineering Command (NAVFAC) and Chief of Civil Engineers. RADM Montoya retired from the Navy Dec. 1, 1989, two months after his goal of establishing a second West Coast EFD in Southern California became reality.

More than 400 people attended the afternoon ceremony, including past and present San Diego area Navy dignitaries, and current and former Southwest Division (SOUTHWESTDIV) employees, a few of whom have returned to work for the new command in the same office spaces they occupied nearly 20 years ago.

Photo by John Elliott

The beautiful downtown San Diego skyline provided the perfect backdrop for the SOUTHWESTDIV dedication ceremonies. The command, under the direction of CAPT F.D. Schlesinger, became NAVFAC's seventh Engineering Field Division on Oct. 1, 1989.

They watched as RADM Montoya ceremoniously transferred control of the command from the Western Division of NAVFAC in San Bruno directly to NAVFAC in Alexandria, Va., before unveiling the command seal, a replica of the one used by the original SOUTHWESTDIV, which was disestablished in 1970. The admiral also unveiled a new command sign in front of the building.

The impressive downtown San Diego skyline provided the backdrop for a picture-perfect setting which was enhanced by having the audience surrounded by more than 50 flags. The flags represented several of the major U.S. wars, the various Department of Defense military service units, and some of the 50 United States.

Captain Francis F. Schlesinger, CEC, USN, is the first commanding officer of SOUTHWESTDIV. He leads a staff of 400 who are responsible for the planning, design, and construction of facilities for the Navy, other services, and federal agencies and offices. The command also provides environmental support for the Navy and Marine Corps complexes in the southwestern portion of the United States and is responsible for acquiring and disposing of real estate for the Navy and Marine Corps in San Diego County.

CAPT Schlesinger has served in San Diego since October 1985, when he assumed duties as executive officer of the Public Works Center here. In January 1988, he became Deputy Officer in Charge of Construction, Southwest. He directed the growth and transition of that command into the Engineering Field Activity, Southwest, where he assumed duties as its first and only commanding officer in December 1988. That command became SOUTHWESTDIV on Oct. 1, 1989.

In his remarks, CAPT Schlesinger noted that "Winston Churchill once said, 'The only thing that is really new is the history we never read.' This is especially appropriate to remember today." He explained that when SOUTHWESTDIV closed its doors in July 1970, consolidation was the panacea for shrinking resources. He said that while there undoubtedly were compelling reasons, a re-

view of the past 19 years has reversed that thinking. "Today we celebrate the return of the engineers to San Diego," he said.

CAPT Schlesinger acknowledged the presence of many former SOUTHWESTDIVers, especially Rear Admiral Jim Davis, a former SOUTHWESTDIV commander and the senior retired CEC officer in San Diego.

He praised the members of his command who worked so hard to bring the EFD into existence, including the CEC officers and the civilian members of the command who represent the present and the future continuity of the command.

The command's multifaceted capabilities are reflected in the 51 position specialties including architects and most of the engineering disciplines; attorneys and real estate, contracts, and natural resources specialists; accountants and budget and management analysts; community planners, computer operators, construction inspectors, surveyors, clerical, and other Navy support personnel.

In closing, CAPT Schlesinger thanked RADM Montoya for his help in getting the new EFD established. "The investment has been made," he said. "I assure you that the return will repay the investment many times over."

Jeanne A. Light is the public affairs officer at the Southwest Division, Naval Facilities Engineering Command in San Diego, Calif.

Officer Materiel Professional Program Undergoing Extensive Revision

As announced by NAVOP 014/90, the Officer Materiel Professional (MP) program is undergoing extensive revision. Of particular interest to CEC officers is the change in the officer communities designated to participate in that program. Although CEC officers and Supply Corps officers have unique skills associated with procurement and logistics support of weapon and ship systems, as well as facilities, they already have their own specialized education and training requirements as well as career paths.

Both staff corps will be considered a part of the acquisition corps (the Navy's senior acquisition workforce made up of officers from the Engineering Duty, Aviation Engineering Duty, Supply Corps, CEC, and MP communities filling designated acquisition billets).

However, because they do not have major weapons systems program management as their primary career goal, the CEC and Supply Corps officers will *not* be a part of the restructured Materiel Professional community. As a result, CEC officers will no longer participate in the MP program and the 5104 designators will revert back to 5100 when directed by the Chief of Naval Personnel.

NAVFAC Reorganizations

On Sept. 30, 1989, Officer in Charge of Construction (OICC) Northwest in Silverdale, Wa., became Engineering Field Activity, Northwest. The EFA will provide expanded support in environmental protection, hazardous waste management, planning and real estate.

On the East Coast, OICC Trident became an echelon four command reporting to the Southern Division, Naval Facilities Engineering Command. This action, which became effective on Oct. 1, 1989, will allow for a smooth transition when OICC Trident is eventually disestablished.

OMES cuts the red tape

Can energy services contracting with the Navy be effective and profitable? It can with Operations and Maintenance Energy Services (OMES), which is a contracting method that cuts through the red tape.

OMES is a fixed price, indefinite quantity-delivery order contract that is fast and flexible. The contract is executed incrementally. The contractor is given $10,000 to $20,000 to conduct an energy audit and optional steam trap survey.

It takes the contractor about 45 days to identify energy conservation opportunities (ECOs) that have a simple payback of two years or less. A couple weeks later, the Navy selects projects for the contractor to implement. The contractor starts on the second audit while taking three or four months to execute projects selected from the first audit.

Contractors are enthusiastic about OMES because the Navy stresses quality components to reduce life cycle costs. The emphasis on quick payback projects and broad scope possibilities gives the contractor a fertile pool of ECOs to offer the Navy.

Two demonstration projects have proven OMES works. FD Services was awarded an OMES contract in the Charleston, S.C., area. The Navy invested $50,000 in energy conservation projects in fiscal year 1989, resulting in a four month payback.

The Construction Battalion Center in Port Hueneme, Calif., awarded an OMES contract to Engineering Resources, Inc. In FY 1990, the Navy will invest $126,000 in ECOs developed by the Charleston contract, with a payback of 1.2 years.

The Navy is soliciting bids on five regional contracts in

January 1990. Each contract contains orders for $500,000 to $1 million. Contractors will be selected based on an evaluation of technical and price proposals. Technical proposals include the qualifications of contractor personnel and related business experience. Price proposals are based on a government schedule which includes line items for energy audits and/or steam trap surveys, hourly labor rates and contractor prices to furnish and install hardware items such as lighting retrofits, programmable thermostats, and steam traps.

For more information on OMES and details on the regional contracts, contact Rita Schuh, Code 1651E, Naval Facilities Engineering Command, 200 Stovall St., Alexandria, Va. 22332-2300, telephone Autovon 221-0102 and commercial (202) 325-0102.

NMCB Five answers calls for assistance in wake of Hugo

By JO3 Daniel Klobnak

Naval Mobile Construction Battalion Five, deployed to Roosevelt Roads, Puerto Rico, answered surrounding communities' cries for help. The Seabee battalion sent men to Ceiba and Fajardo, two municipalities near the naval station, to help restore many of the homes damaged by Hurricane Hugo. The Seabees also helped the people of Vieques Island in their recovery efforts.

Since the hurricane swept through the Caribbean and Eastern Seaboard, NMCB Five has responded to various locations—pitching in on recovery efforts at Charleston, S.C., and Antigua, as well as Puerto Rico. Although most of the work focused on naval bases and camps, the men of Five utilized their extensive construction skills for neighboring communities as well.

Recounting the Puerto Rico efforts, Commander David F. Walsh, NMCB Five's commanding officer, said, "We were tasked with initial hurricane recovery operations because of our ability to respond quickly to an adverse situation."

Working side by side with volunteers from the Hewlett Packard manufacturing plant located at Aguadilla, on the western end of Puerto Rico, and Marines from the Marine Corps Security Force Company, Roosevelt Roads, men from Five installed flame retardant plastic roofing on homes in Ceiba, a barrio close to the naval station. The project received high level attention in Puerto Rico, including a personal visit by Puerto Rico's governor.

According to Nicolas Davila, a volunteer and acting supervisor of the Ceiba project, the idea was to "help people out of the schools, where they're living...re-establish the normal life of Ceiba." Their work was cut out for

Builder Third Class William B. Burney Jr. and Steel Worker Constructionman Curtis J. Houchins Jr. of Naval Mobile Construction Battalion Five carefully align a brace for a floor which is part of the community shelter constructed for Ceiba residents left homeless by Hurricane Hugo.

them. First estimates indicated that 700 homes needed to be roofed. Current estimates, supplied by the Red Cross, put that figure around 1,350. Despite an average of only 90 minutes per house, the operation will continue well into 1990.

Many families, however, lost more than their roofs. A 24-apartment barracks with community laundry, kitchen, and rest rooms was built to replace destroyed homes. Davila said it took three weeks to complete the project. Seabees from NMCB Five assisted in constructing the facility.

Seabee relief efforts extended beyond the city limits of Ceiba, however, as work crews from Five also helped the citizens of Fajardo and Vieques Island with their cleanup operations. Five hauled debris away on dump trucks while front-end loaders removed the more cumbersome chunks of collapsed houses and uprooted trees.

As an additional tasking, Five's detail assigned to Vieques Island used their special talents in helping developing industry in the town of Isabella recover from the storm. Steel Worker Constructionman First Class Mark Giardina, officer in charge of the detachment, explained that his group of 15 Seabees helped remove and haul away portions of the roof of the Sunray Setting Factory, most of which had collapsed during the hurricane.

They then repaired the entire roof. SW1 Giardina and his men also helped rebuild the local community dump site at Isabella.

The citizens of all communities greatly appreciated the Seabee's performance. CDR Walsh said citizens greeted the Seabees on the job daily, offering soda and sandwiches to the troops.

CDR Walsh said the battalion enjoyed the tasking. "'Bees like hands-on work, contact with the local community, and, most of all, the opportunity to help people. It's what being a Seabee is all about."

Davila told of a time in Ceiba when a woman holding a baby approached some 'Bees finishing up after a long day of working on roofs under Puerto Rico's sweltering sun. They moved to their vehicle, their thoughts set on some much needed rest. The woman asked them to repair her home. Builder First Class Gregg Morrison, the crew leader, turned to the others. "There's a baby involved, what do you think?"

Without a word of complaint, they picked up their hammers and went to work.

Former magazine editor dies

It is with sincere regret that we inform you of the death of Harold Thomas Welch, a former editor of the *Navy Civil Engineer* magazine, this past December. He was 59. He had been editor from May 1974 to July 1983.

RADM Benjamin F. Montoya, CEC, USN (Ret)

RADM Montoya receives Hispanic Engineer of the Year Award for 1989

Rear Admiral Benjamin F. Montoya, CEC, USN (Ret), former Commander of the Naval Facilities Engineering Command and Chief of Civil Engineers, received the Hispanic Engineer of the Year Award for 1989.

He was cited for his excellence in engineering, science and technology at the First Annual Hispanic National Achievements Awards Conference in Houston, Texas, this past October. The conference was sponsored by the *Hispanic Engineer Magazine*.

RADM Montoya built an impressive 31-year career to become the Navy's top civil engineer and Commander of the Naval Facilities Engineering Command. His credentials include more than his distinguished military career; he is also an engineer, a lawyer and an environmentalist.

He is a member of the American Society of Civil Engineers and of the Mexican-American Engineering Society; former national president of the Society of American Military Engineers; and a member of the Executive Advisory Council of the Society of Hispanic Professional Engineers. He is also a member of the American Bar Association and the Washington, D.C., bar.

RADM Montoya retired from the Navy on Dec. 1, 1989.

Writing for the *Navy Civil Engineer* Magazine

The *Navy Civil Engineer* magazine has a new home at the Naval Facilities Engineering Command headquarters in Alexandria, Va. It relocated from the Naval School, Civil Engineer Corps Officers in Port Hueneme, Calif., in October 1989 to give it a more national scope.

We encourage you to write articles for the magazine. The upcoming issues of the *Navy Civil Engineer* are planned months in advance, so drop the editor a note or call the editorial office to discuss your proposed article. This way you can make sure your article meets our editorial requirements.

Here is a brief guide for writers interested in contributing to the magazine.

Articles

The magazine is layed out using desktop publishing, so we are encouraging writers to submit articles on computer disks. We accept articles written in Multimate Advantage II, Word Perfect, and other PC-compatible software. For Macintosh users, we accept articles written in Word, MacWrite, and Write Now. If you have any questions about software, please call the magazine's editorial office. Also, enclose a hard copy of the article with the disk. At your request, we will return your disk to you after your article has been edited.

For those of you who are traditionalists, typewritten articles will be gladly accepted.

All articles, regardless of the format in which they are submitted, should be double-spaced with 1 to 1.5 inch margins.

Manuscripts should be submitted to the editorial office.

Art

The submission of artwork (photographs, line drawings, charts, graphs, etc.) illustrating your article is encouraged. All artwork will be returned to you at your request.

Photos should be 5" x 7" (or larger), black and white, and clearly identified. DO NOT WRITE ON THE PHOTOS. Write identifying information on a piece of paper and tape it to the back of the photo.

If you have chart or graph information on a spreadsheet, it would be useful for you to send a disk with the spreadsheet data on it.

Security clearance

All articles and artwork submitted for publication *must* be accompanied by a completed Publication Security Review and Clearance form (NAVFAC 5720/6 (REV 10-81)).

Editorial office

The editorial office address is Naval Facilities Engineering Command, Attn: Editor, *Navy Civil Engineer* Magazine (Code OODA), 200 Stovall Street, Alexandria, Va. 22332-2300.

The telephone numbers are Autovon 221-0310 and commercial (202) 325-0310.

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If you are a young engineer or architect, please call a Reserve representative listed below.

LCDR Scott Cleveland
Atlantic Region, RNCF
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Charleston, SC 29408
Phone: (803) 743-2650/4322
AV 563-2650

LCDR Doug Stauffer
Western Division, RNCF
1220 Pacific Highway, Building 131
San Diego, CA 92132
Phone: (619) 532-1443/2970
AV 522-1443

Or, contact an active duty EFD Accessions Officer listed on the inside front cover for further information and details.

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